Nutrient management in alfalfa-corn silage rotations

DOE OIC

UMN Ext

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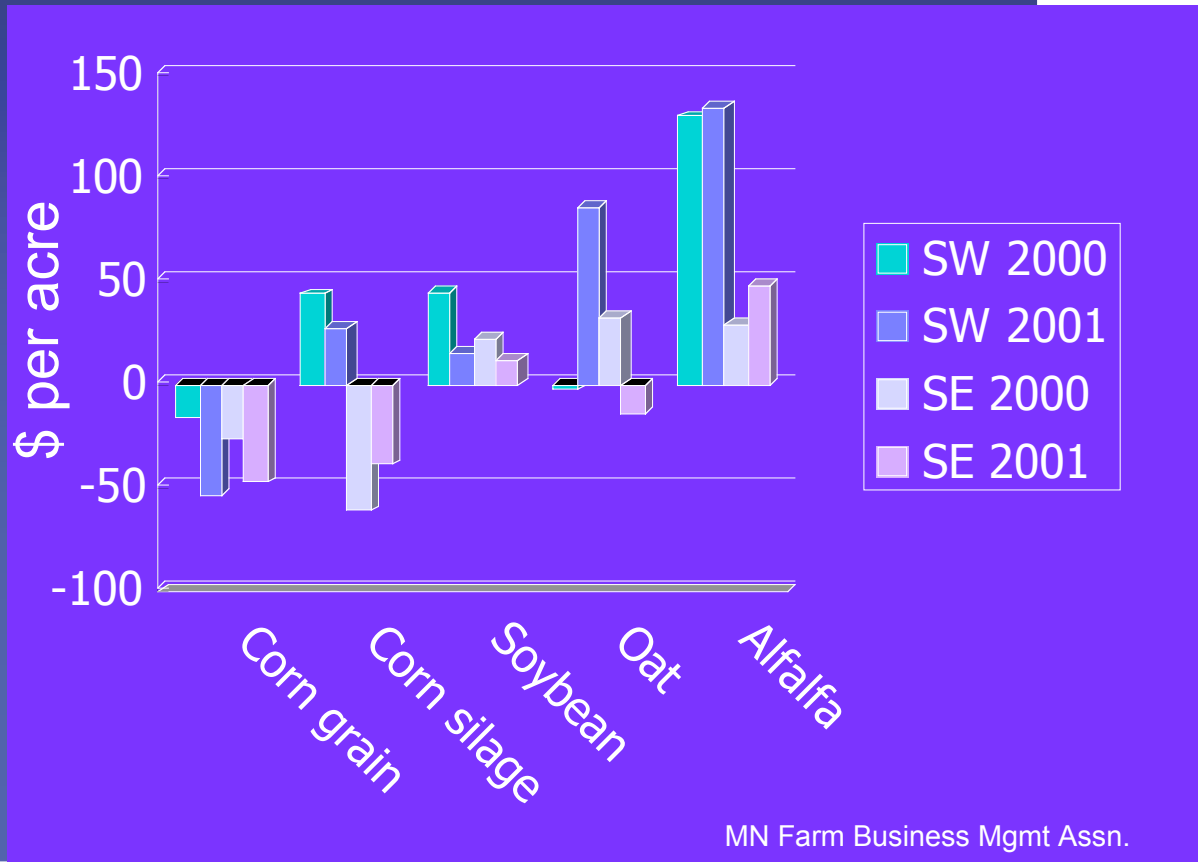
St. Paul, MN

Problems with the C/S rotation

OMAF, Ontario

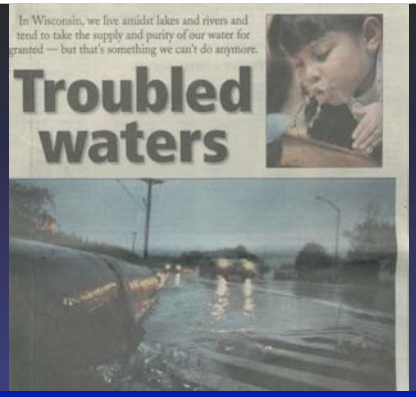
Net return over labor and manage

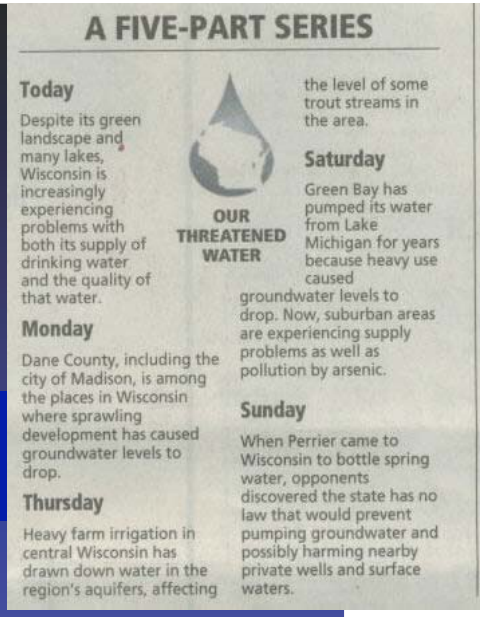
(No government payments inc



MN Farm Business Mgmt Assn.

NCAT

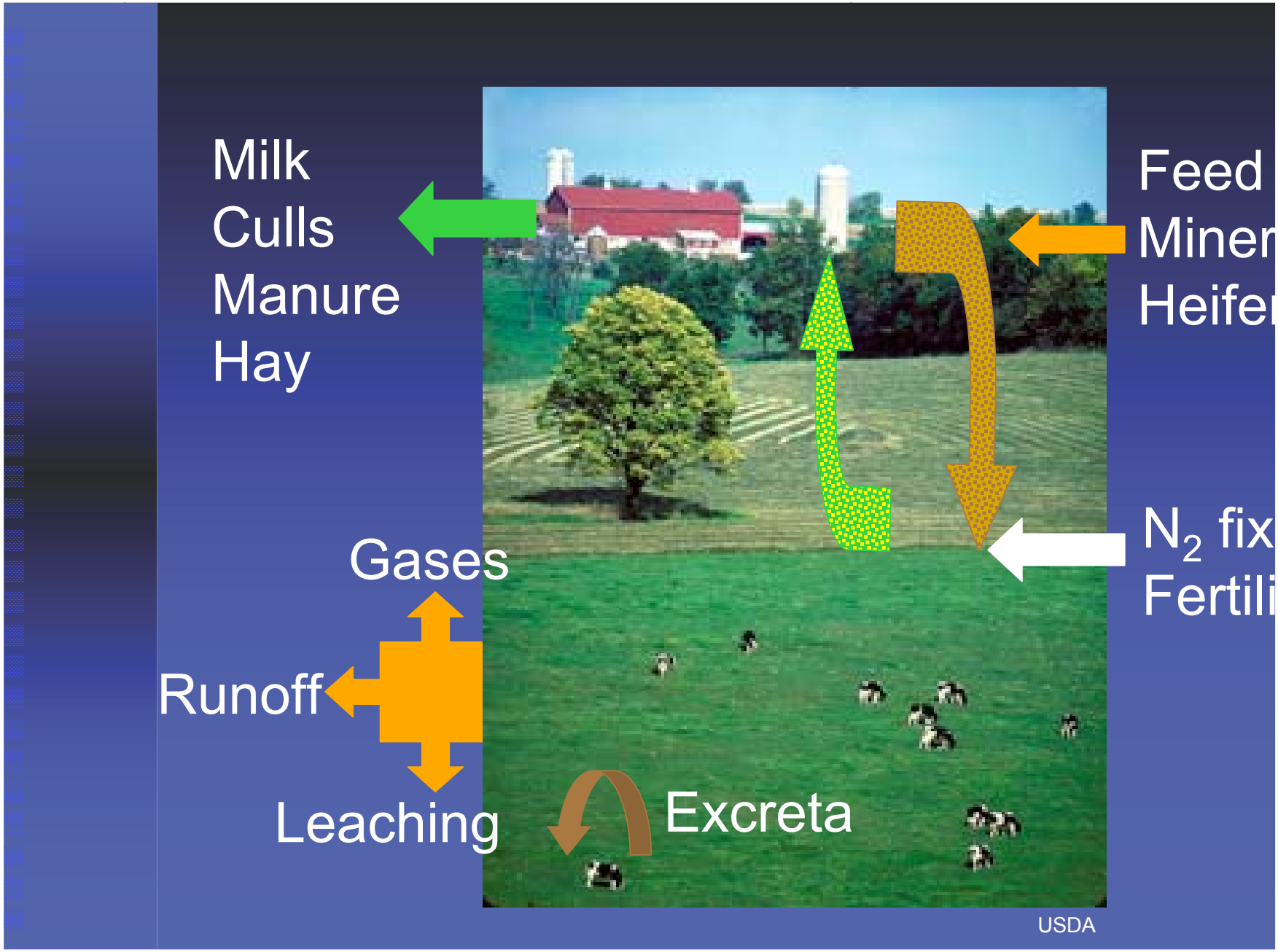


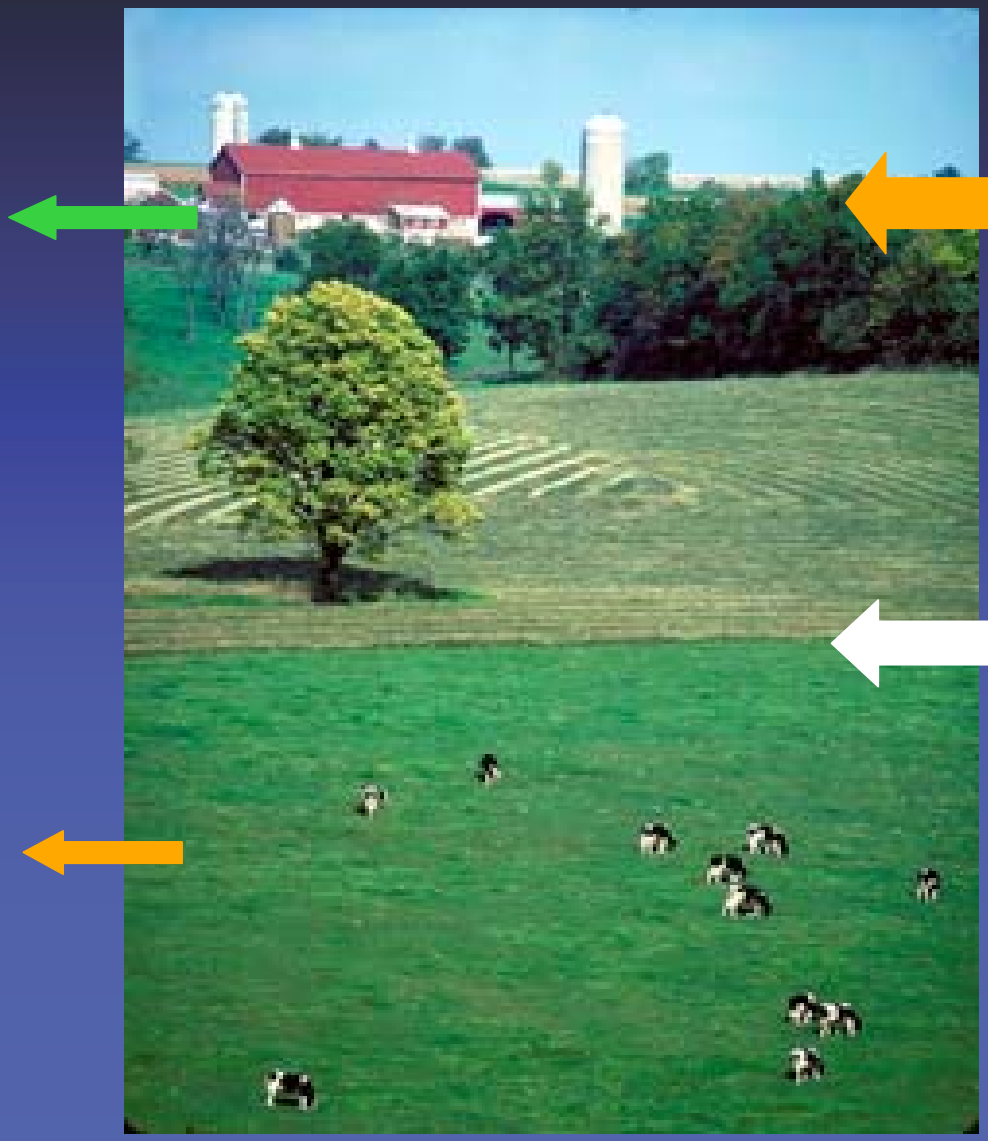


The public is interested

- Over 80% are concerned about water and air pollution, and loss of habitat
- Over 80% agreed that stricter laws are needed to protect the environment [2]
- Nearly 90% in the Midwest favor additional incentives for farmers [3]

[1] nationwide Gallup Organization poll, 2001
[2] nationwide poll by Pew Research Center for the People and the Press, 1999
[3] regional poll by American Farmland Trust, 2001

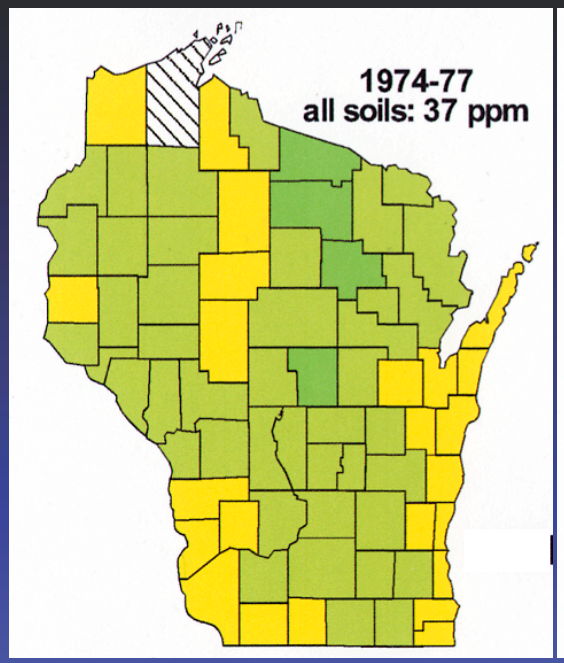

Milk
Culls
Manure
Hay
Feed
Miner
Heifer
N_2 fix
Fertili
Gases
Runoff
Leaching
Excreta
USDA

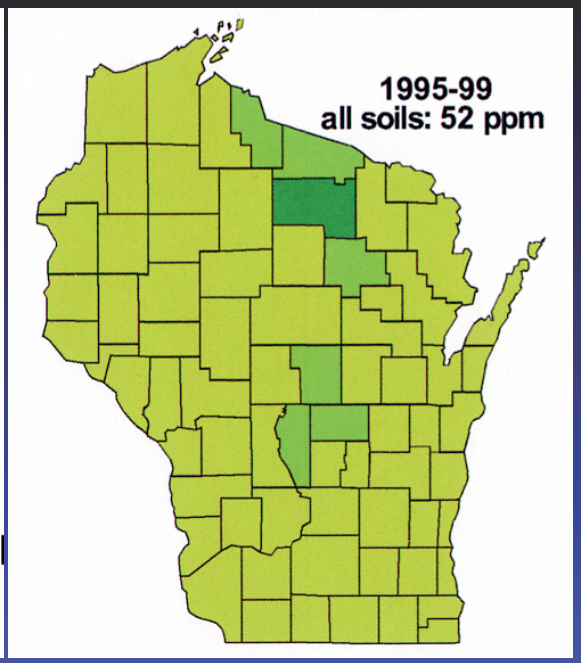


USDA

Between 40 and 80% of P imports are retained on the farm

Klausner



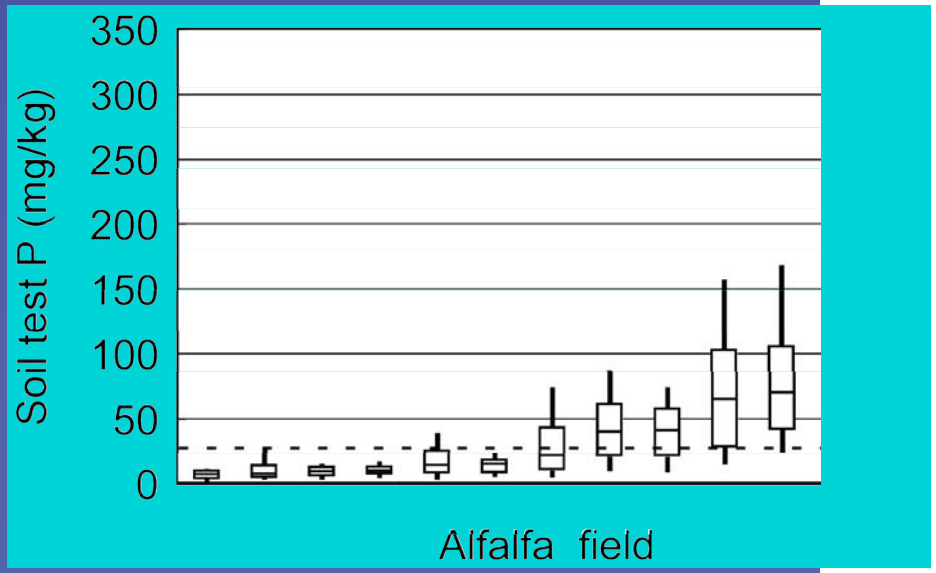


Combs et al., 2001

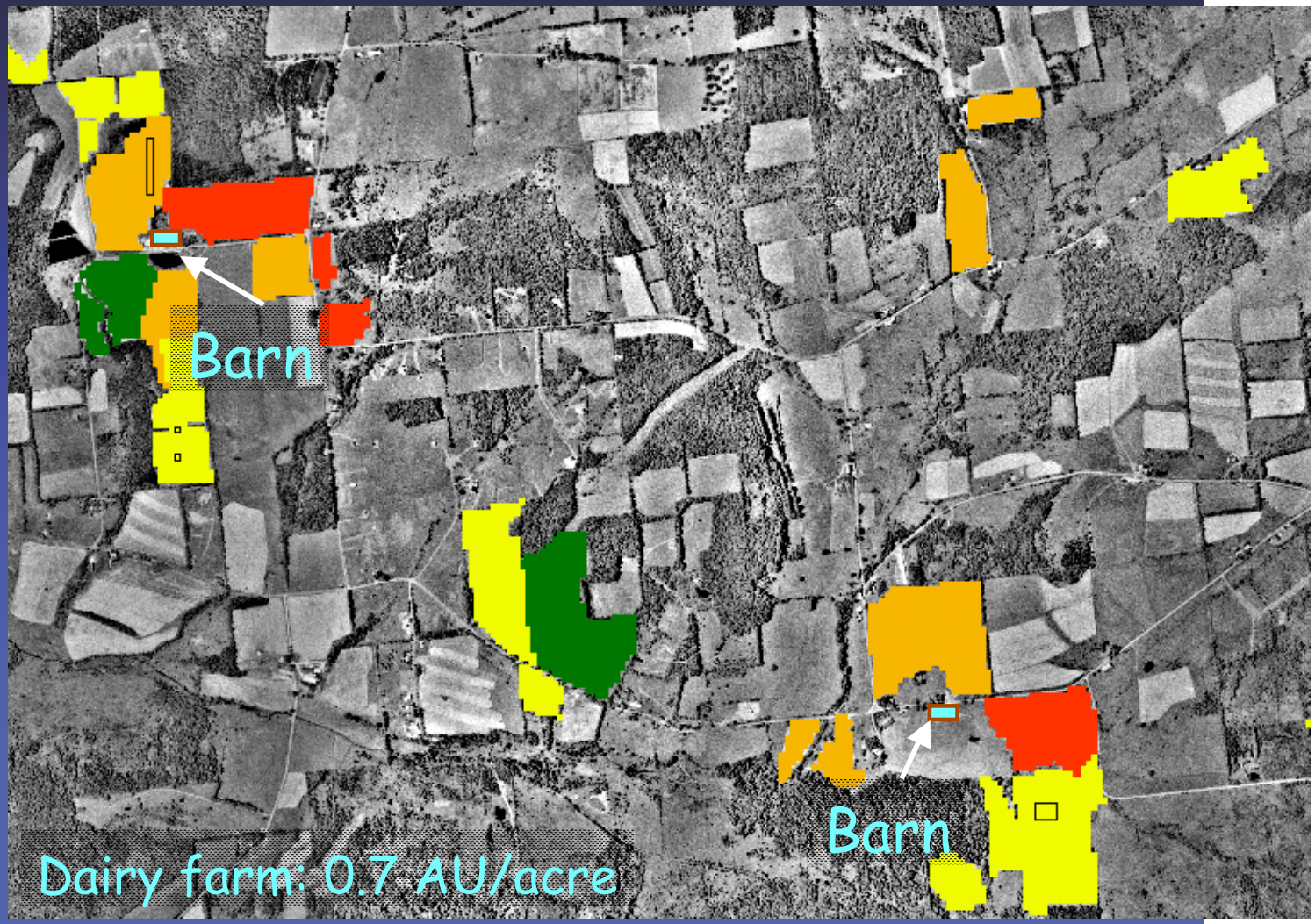
No WI counties with soil test P lower than 30 ppm

Russelle et al

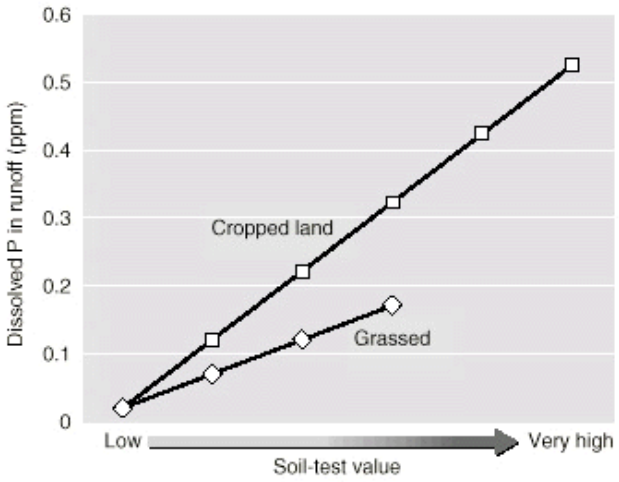
but not all fields have sufficient P



Long term soil P accumulation

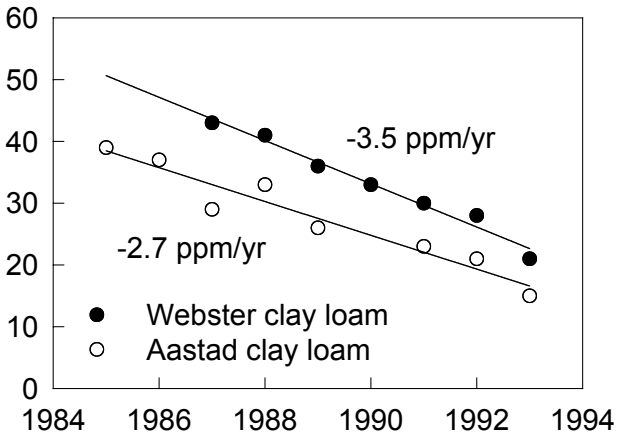


Kleinman et al.



UIUC

- Erosion control alone will not stop P runof
- Most BMPs are not permanent solutions improving water qua



Randall et al., 1997

The only permanent solution is to balance P inputs and outputs on individual farms

Sharpley, 1996

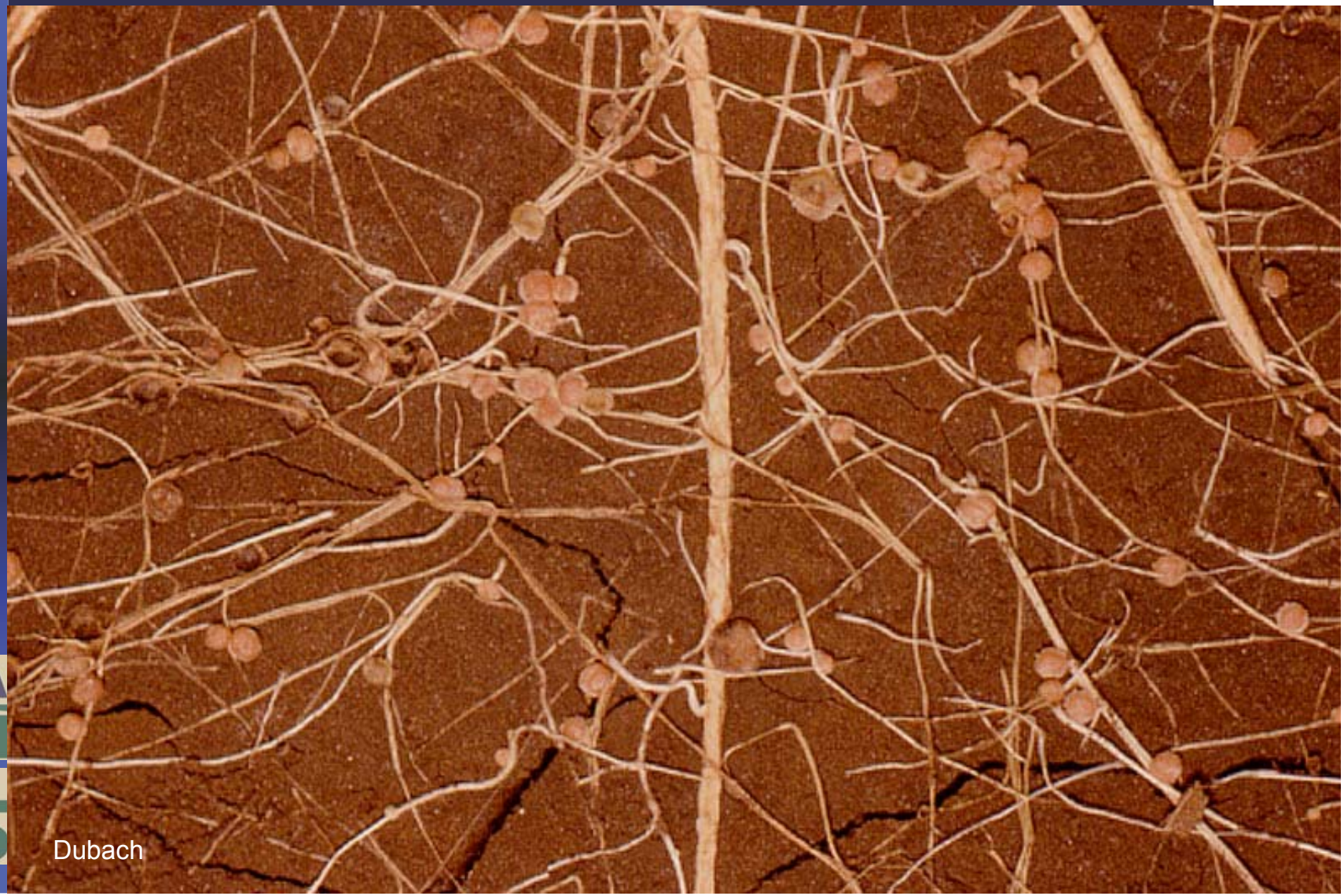
Whole-farm P balances
46 NE USA dairy farms

Dairy type	Animal density	Annual Milk	P Import	A r
	AU/a	lb/cow	lb/a	
Confinement	0.8	20,800	43	
Pasture				
Non-organic	0.5	15,300	15	
Organic	0.3	12,100	6	

P imported as feed, mineral, and fertilizer – ***57% not exported***

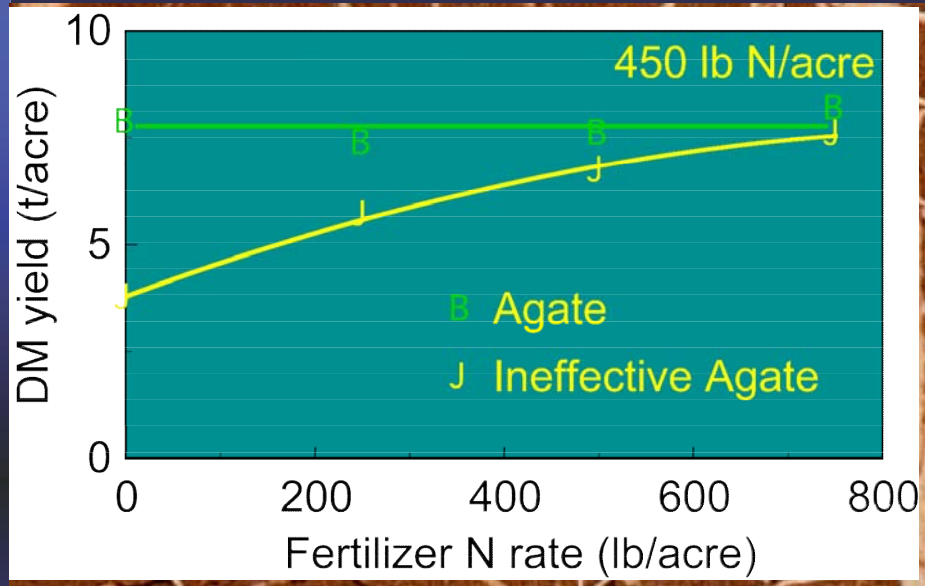
Anderson and Magdo

Legumes help balance N



Dubach

Legumes help balance N



Dubach

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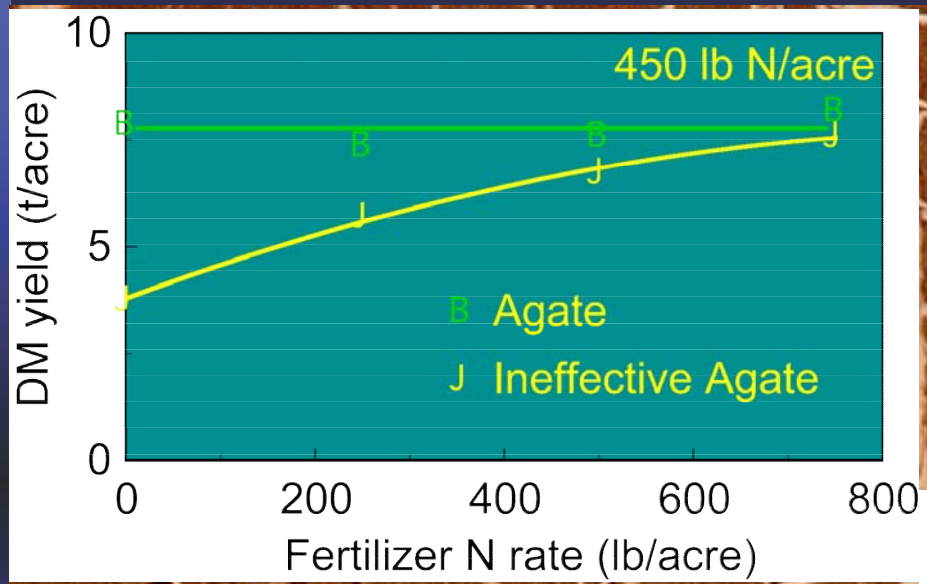
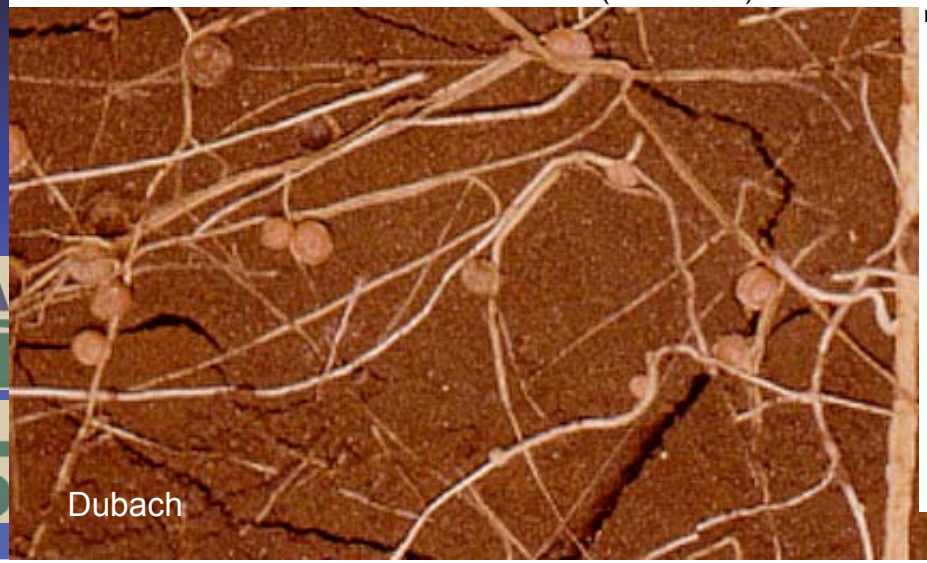
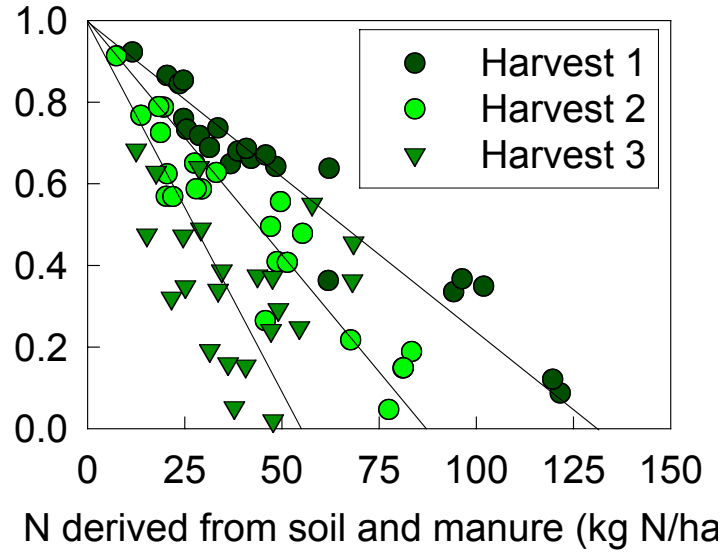






Russelle et al., 2003

Nutrient removal

Crop Watch, Univ. Nebraska

Univ. Arkansas

	Corn silage	Alfalfa silage	
N	10-15	50-60	lb/dry t
P	2- 4	4- 7	lb/dry t
K	10-15	25-60	lb/dry t

Neither crop removes P quickly

Alfalfa is a great crop to remove excess N & K

Nutrient removal

Trelay Seed Co.

Trelay Seed Co.

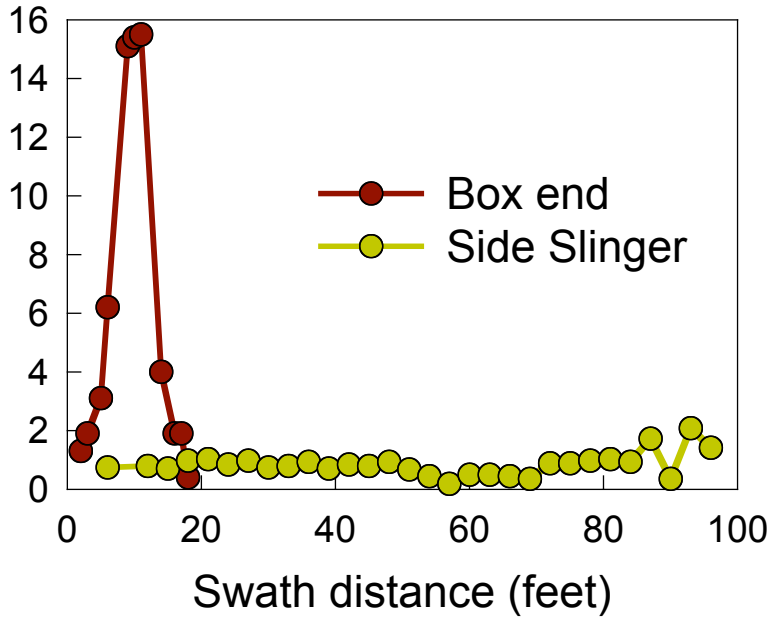
	Corn silage	Alfalfa silage	
Yield	15	3.5	t/a
N	120	170	lb/a
P	29	16	lb/a
K	120	130	lb/a

Yield averages for IL, IA, MN, WI, 1997 (NASS)

N management decisions

- Who uses manure N credits to reduce fertilizer N rates?
- Who uses legume N credits to reduce fertilizer N rates?
- Who has fields where a lot of manure has been applied over the years?
- Who does soil testing *for N* (PSNT, late fall deep cores, etc.)?

Manure applications



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Manure application with corn silage

Two recognized windows of opportunity:

Preplant	*Too little time*
Post-harvest	*Excess nitrate producti*

Potential for sidedressing low rates

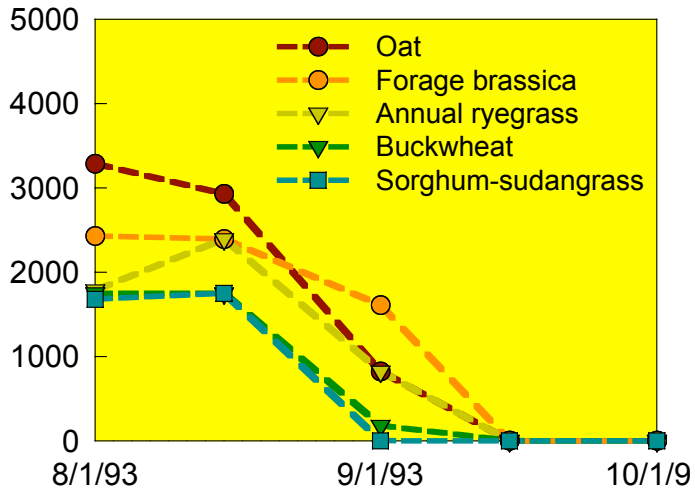
Should give credit for at least two years

Second year credit averaged 12%

of total dairy manure N applied

(Cusick et al., 2002)

Cover crop growth after silage corn



Latest practical seeding date

Biennial and perennial legumes (red clover, sweetclover, alfalfa)	August 1
Annual and winter legumes (berseem clover, hairy vetch, medic)	August 15
Warm-season annuals (buckwheat, sorghum-sudangrass)	August 15
Cool-season annuals (oat, ryegrass, brassicas, winter rye)	September 1

Manure application for alfalfa

- Preplant manure provides P, K, S, B, etc. and is an excellent soil conditioner
- Alfalfa can utilize manure N
- Apply at rates to avoid P build-up
  And apply rates for 2 to 3 years of P remo
  except on sands (nitrate losses
- Mix preplant manure well (salt damage)
- Avoid companion crops (lodging)

Manure application on alfalfa

Ken Hammond, USDA

Manitob

Tim McCabe, USDA

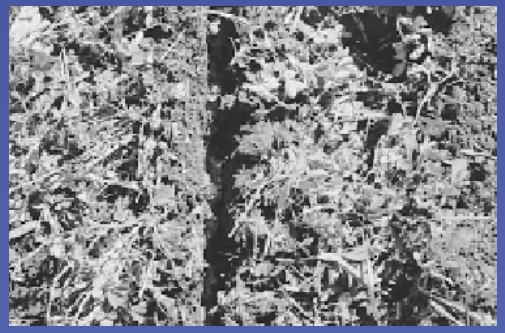
Ballagh Liquid Technologies, Inc.

BAAP, Lithuania

Apply moderate rates

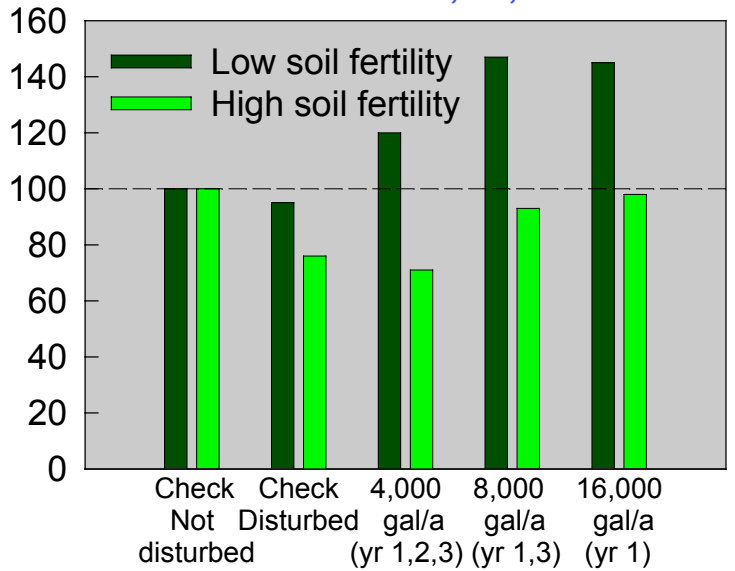
Avoid compaction

Slurry injection in alfalfa



Prairie Agricultural Machinery Institute, Saskatchewan

Yield increases when P, K, or S are low

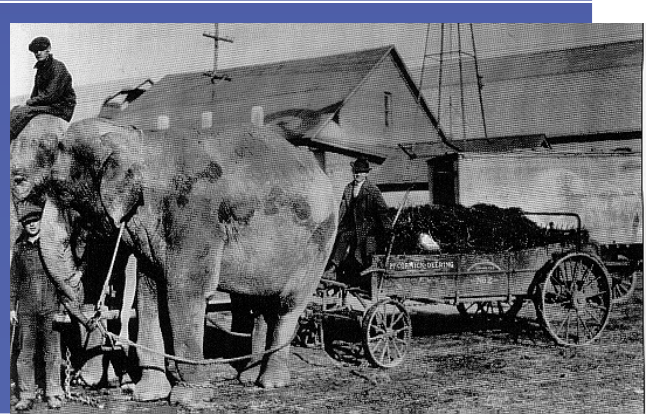


PAMI,

Manure application on alfalfa

Russel

Reason given for topdressing manure	%	Reason given for NOT topdressing manure
Spread manure during summer	25	Lack of time
Good place to use nutrients	25	Lack of uniformity of spreading
Need to empty manure storage	11	Increased weed problems
Fields are close to storage	8	Manure is used on other crops
		Fields are not close enough
		Manure damages the stand



Potential problems

NH_4^+-K^+ competition – decreased winterhardiness

(Joern and Volenec, 1996)

Excess forage K

Keep soil K in optimum range

Manure on foliage can reduce silage fermentation

Inoculate before ensiling (Wiederholt et al., 2002)

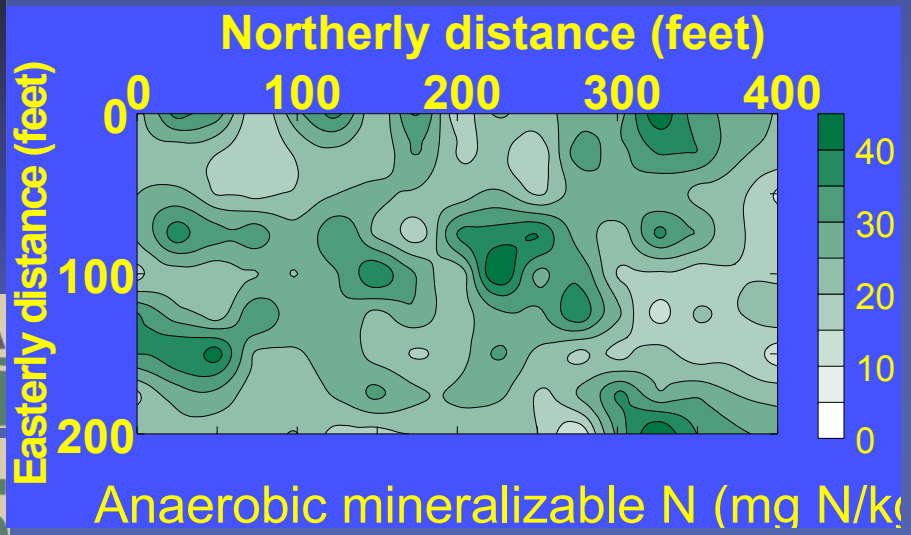
Disease transmission?

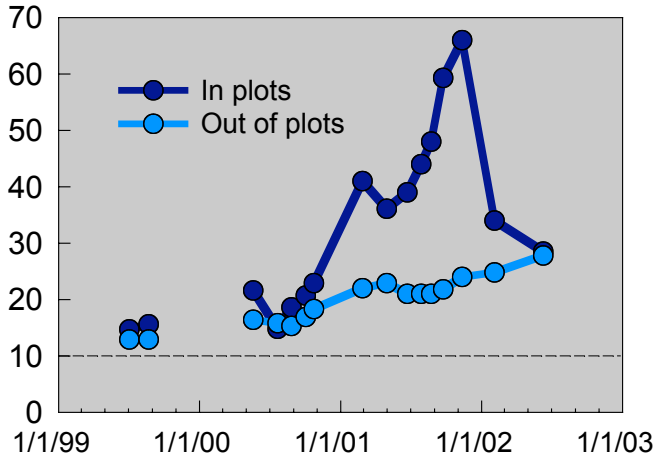
Excess N generation

WORST application time is before terminating stand

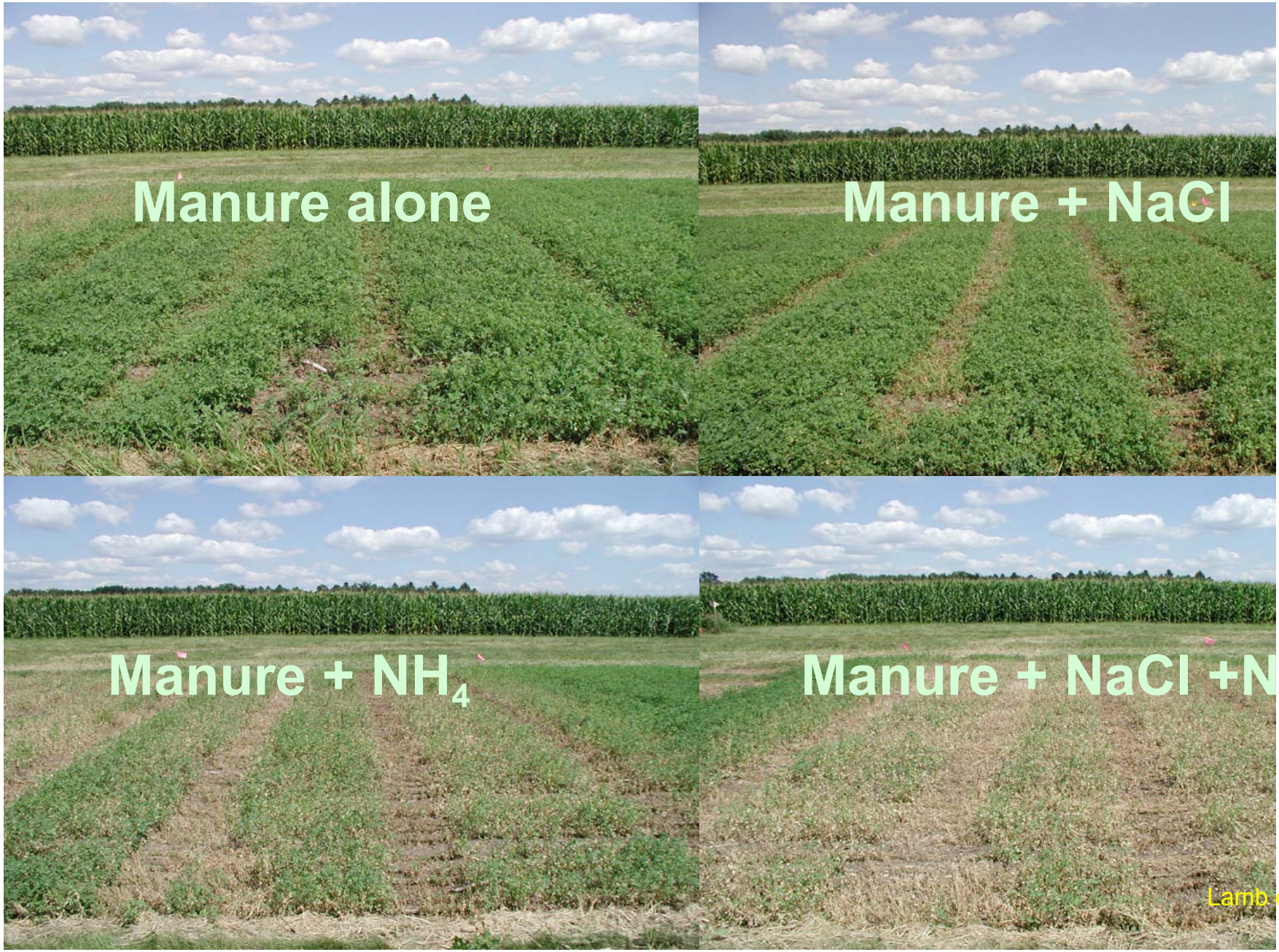
If stand is poor, may apply very low rates

Even the Queen has limited power





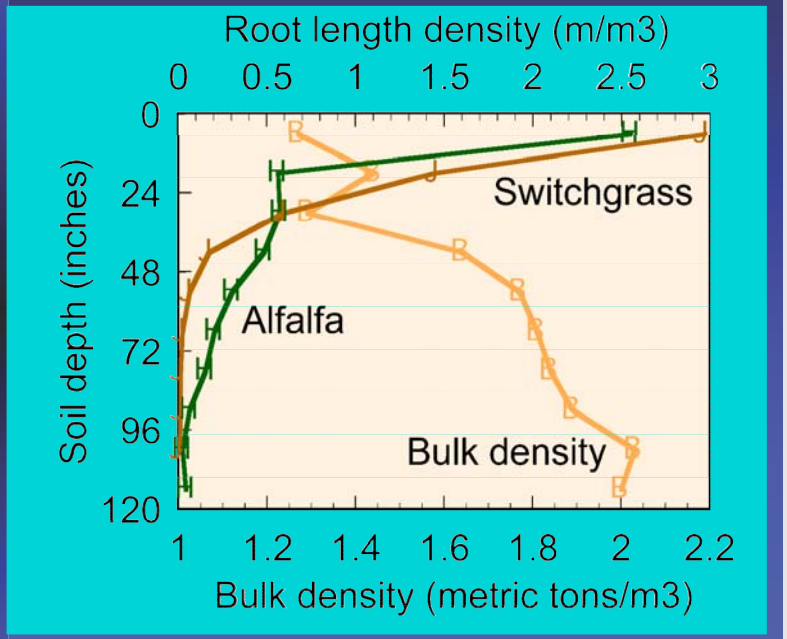
Russelle et al.



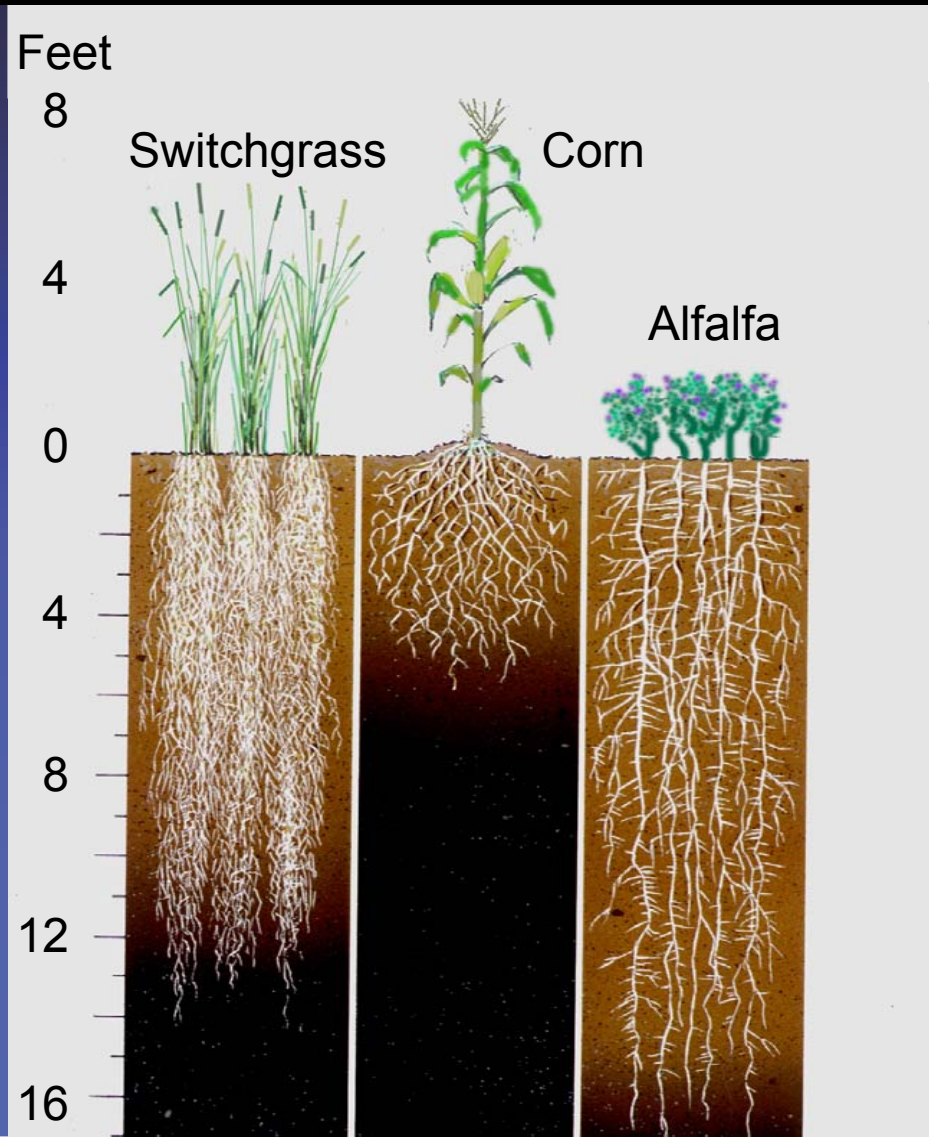
Lamb et al., 2002

Alfalfa helps protect water quality

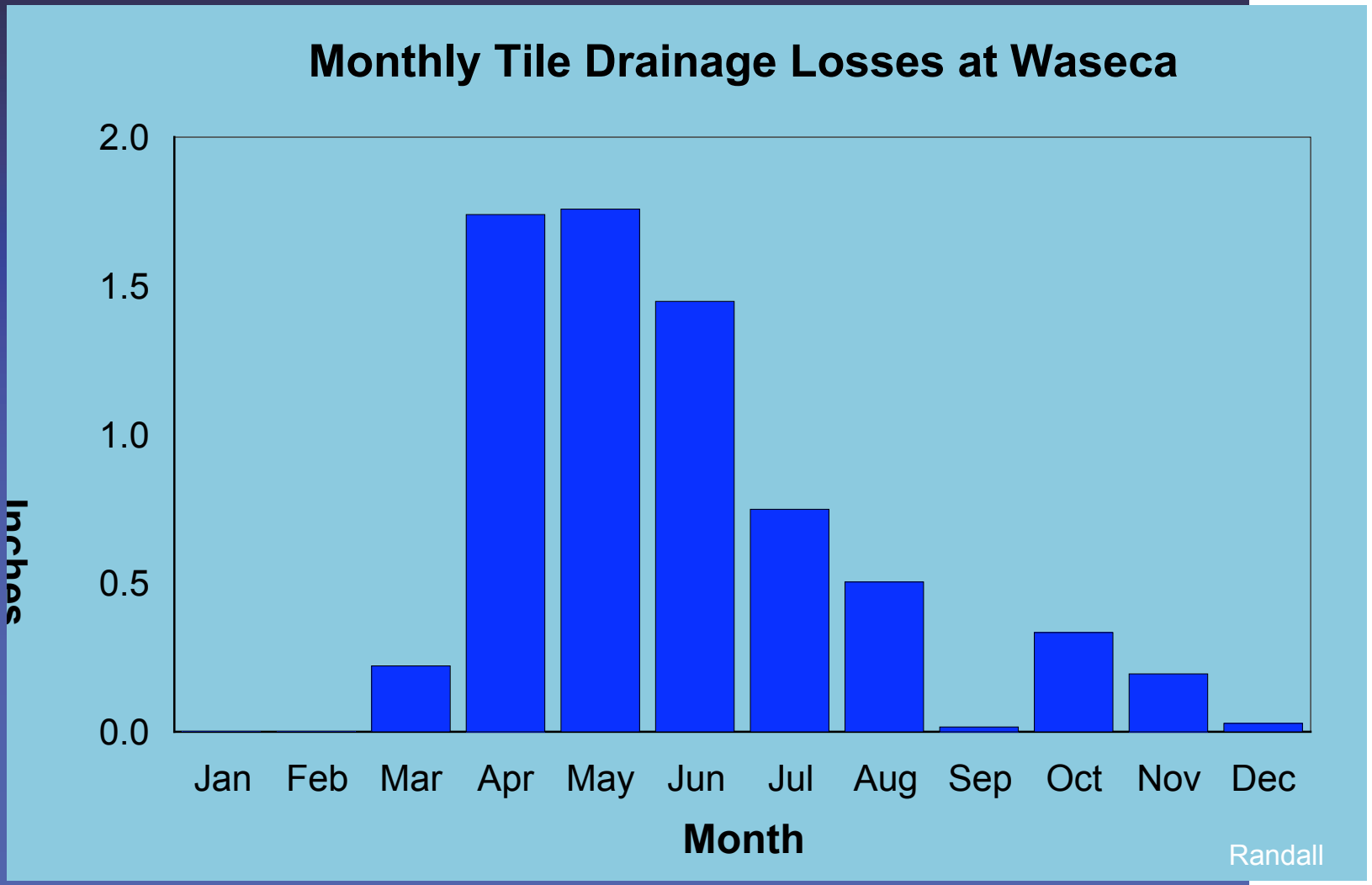
Rooting depth



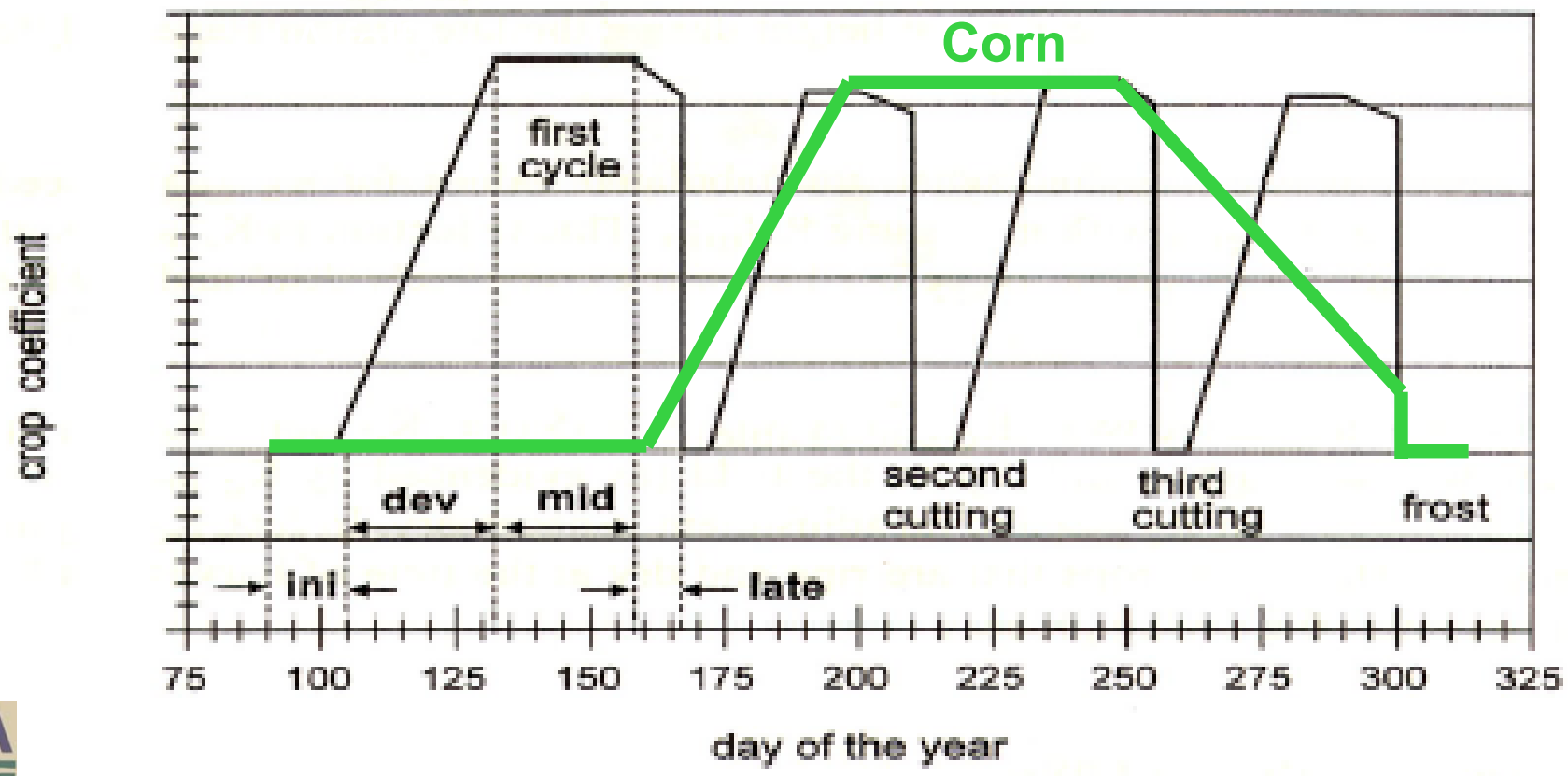
Russelle et al., 1993



When does leaching occur?



Water use by alfalfa and corn

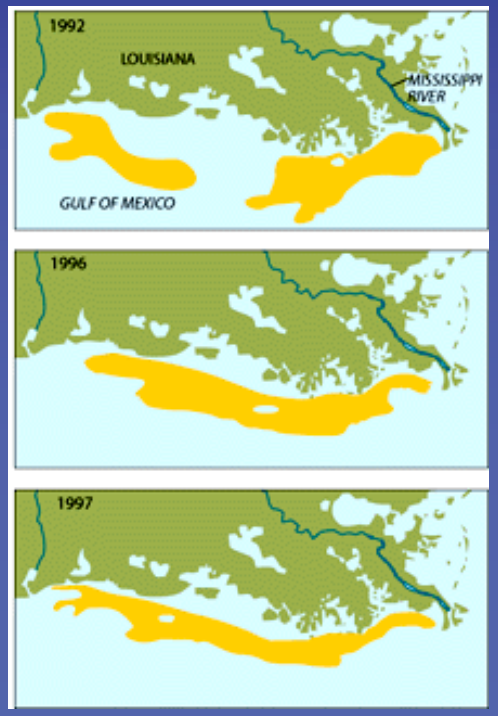


The Dead Zone

Gulf of Mexico

"Scientists and fishermen fear that the Gulf of Mexico is becoming a virtual graveyard for the livelihood of shrimper trawling off the Louisiana and upper Texas coasts."

MS State Univ. Ext. Serv. Sept 2002



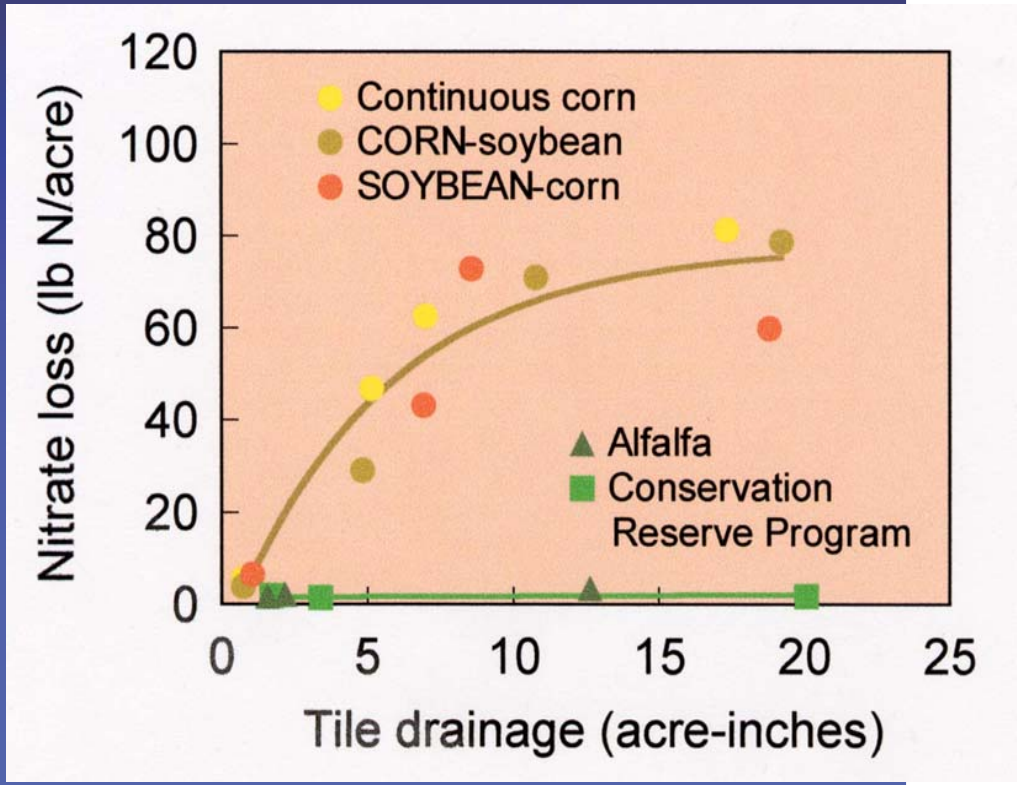
USGCRP

Franklin J. Viola

David

Perennial forages reduce nitrate loss from tile drains –

a partial solution for hypoxia?



Randall et al.,

A little nitrate adds up

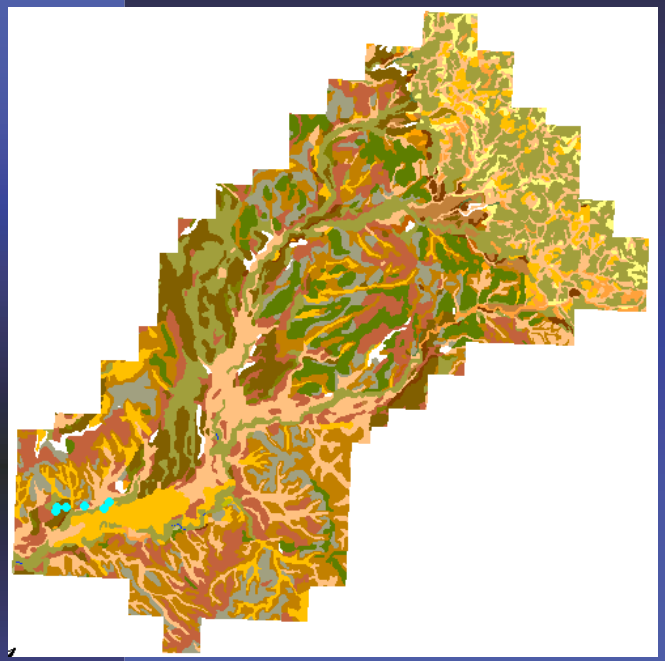
40 million acres are tile drain
in the Midwest

90% in corn or soybean

Average loss = 30 lb N/acre/

Total loss > **1 billion lb N/year**

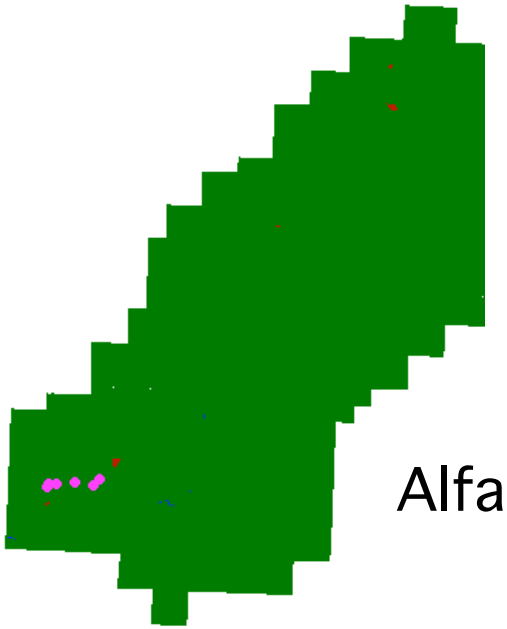
Strategic planting of alfalfa



Predicted nitrate loss GLEAMS

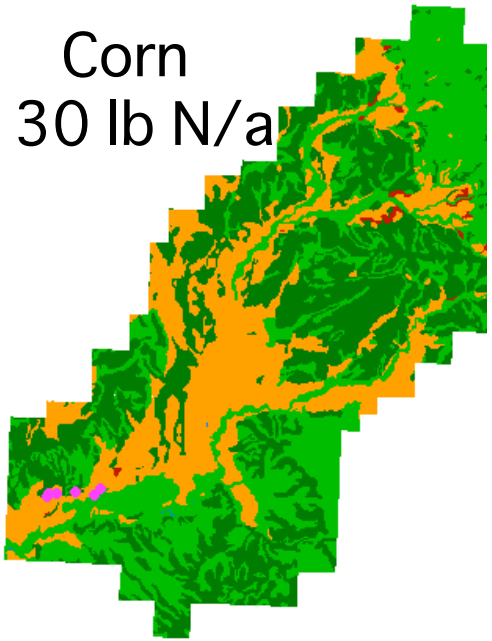
< 2 lb N/a Dark green
2-4 lb N/a Light green
4-8 lb N/a Yellow
8-16 lb N/a Orange
> 16 lb N/a Red

Kelley and Russelle, 2002



Alfalfa

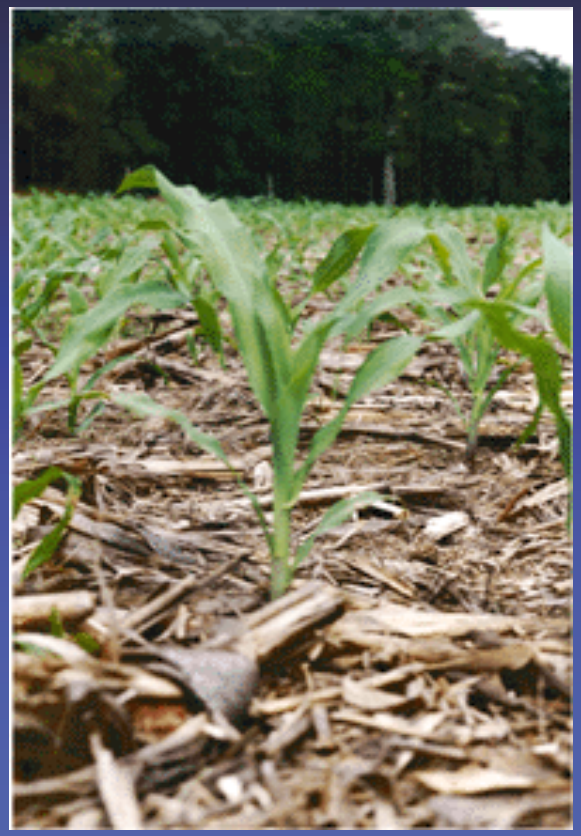
Corn
130 lb N/a



1st year fertilizer N credit after alfalfa

State	Regrowth	Good	Fair	Poo
		- - - - lb N/acre - - - -		
IL		100	50	0
IA		- - - - 150 - 180 - - - -		
MN		150	75	40
MO		120-140	40-60	0-2(
NE		150	120	90
SD		150	50-100	0
MI,IN,OH		140	100	40
WI	< 8″	150	120	90
	> 8″	190	160	130

Pre-sidedress N test (PSNT)



There is increasing attention to agriculture's effect on the environment

Farmers and consultants can avoid or mitigate regulatory solutions by:

- using conservative nutrient management
- increasing acreage of perennials, like alfalfa
- communicating effectively